Multiple-frequency technique of Chung_Li VHF radar: phase calibration and observational results (中壢特高頻雷達之多頻率技術：相位校正與觀測結果)

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Abstract

VHF/UHF atmospheric radars usually yield range resolutions of tens of meters to hundreds of meters in sampling the radar echoes of refractivity irregularities, making it difficult to resolve thin layer structures in the sampling range gate, and thereby difficult to examine fine-scale variations/dynamics of such layer structures. Because of this deficiency, a technique using multiple carrier frequencies, termed range imaging (RIM), has been applied, which can give a range resolution of several meters for radar echo distribution.

To obtain a high-resolution range distribution of radar echoes with RIM, inversion algorithms such as Capon's method [5] and maximum entropy [2], which were initially introduced to multiple-receiver coherent radar imaging (CRI) to determine multiple echo centers in the radar volume [2,4], have been employed. These algorithms enable us to recognize multiple irregularity layers in the radar volume and then give estimates of altitudes and thicknesses of the layers. In this study, Capon's method, which has been demonstrated to be robust and handy [3,5,6], was used.

The RIM technique is now available in the new Chung-Li VHF radar system (24.9^{o}N, 121.1^{o}E), with a central frequency of 52 MHz. Using a novel phase calibration approach that can indicate the effects of phase bias and range-weighting function on the received radar echoes [1], we have validated the RIM technique used with the Chung-Li radar by examining various radar experiments with different pulse lengths, mono and coded pulses, evenly and unevenly spaced frequencies, and receiver filter bandwidths. Practical observations also revealed some small-scale atmospheric structures like small-amplitude wavy layers, double-layer structures, convective motion, and small-scale Kelvin-Helmholtz (KH) billows. All of these structures are difficult to discover from the signal-to-noise ratio (or height-time intensity) of radar echoes having a 150-m or 300-m range resolution.

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投稿議程：

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